A1

However, when using a generally small size, low cost parallel plate method film formation apparatus for depositing a film to a flexible substrate while conveying the substrate by a conveyor device, wrinkles in the substrate become a cause of irregular film formation, which is a problem. A film formation apparatus in accordance with a parallel plate method is shown in Figs. 1A and 1B. Fig. 1A is a side face of the entire film formation apparatus, and Fig. 1B is the vicinity of an electrode 108 and a flexible substrate 101 as seen from below. The electrode 108 is grounded, and a heater is incorporated therein to heat the flexible substrate 101 as needed. Regarding a method of setting the substrate, first the flexible substrate is rolled out from a roll-out roll 105, the flexible substrate passes through gaps 103 formed in substrate conveying portion side faces of a roll-out vacuum chamber 110 and a film deposition vacuum chamber 102, the flexible substrate passes between the electrode 108 and an opposing electrode 109, passes through gaps 112 on the right side of the film formation vacuum chamber, and then, is rolled onto a roll-up roll 104. In order to maintain the substrate in parallel with the electrodes, a constant rotational torque is generated in the roll-up roll 104 and the roll-out roll 105, and a tensile force is applied to the substrate. The substrate is in a state of being suspended

between guide rollers 106 and 107 at this time. Further, the flexible substrate stretches and shrinks, and therefore a lengthening force exists in the direction in which the substrate is being conveyed, and a contracting force exists in the width direction, in every portion of the flexible substrate suspended in the air and under application of the tensile force. This causes wrinkle 111 in the substrate. The expansion and shrinkage of the flexible substrate become large when heated by the heater, and wrinkle appears conspicuously. Furthermore, the film is formed with the portion that has been wrinkled exposed to an electric discharge, and this is therefore a cause of uneven film formation. The longer the electrode, namely the longer the portion of the substrate suspended in the air, the higher the frequency of wrinkle becomes. Note, reference numeral 113 indicates a roll-up vacuum chamber.

A1 cut

Please replace the paragraph beginning at page 3, line 19, with the following rewritten paragraph:

A2

The increase in size cannot be avoided in a film deposition apparatus provided with a conveyor device of cylindrical can method, but in thinking about making the apparatus smaller, a method of using an improved parallel plate method can be considered. In this improved method, the portion contacting the flexible substrate and supporting the conveyance of the

substrate may be made into a curved shape. A conveyor device using a curved surface electrode as a conveyance supporting portion, and a film formation apparatus provided with the conveyor device are shown in Figs. 2A and 2B, respectively. A curved surface electrode 201 serves as both a conveyance supporting portion and an electric discharge grounding electrode. By applying a tensile force to a flexible substrate 204, the substrate is brought into close contact with the curved surface electrode, and wrinkles in the substrate can be suppressed. This method is remarkably superior to the cylindrical can method with respect to the point of making the apparatus smaller, and makes the apparatus a similar size comparable to that of the parallel plate method. However, a problem is that if the substrate is conveyed while a tensile force is applied thereto, the substrate, being in contact with the curved surface electrode during the conveyance, receives in its back surface abrasions due to rubbing between the back surface of the flexible substrate and the curved surface electrode. Another problem is that the longer the electrode becomes, the larger the friction force grows, which increases a force for winding up the substrate during conveyance and also increases a force working on the substrate to a considerable degree. Note, reference numeral 202 denotes an opposing electrode; and 203, a guide roller; and 205, a wrinkle.

A2 cont

Please replace the paragraph beginning at page 8, line 5, with the following rewritten paragraph:

A3

Comparing a film formation apparatus having a curved surface roller method conveyor device, and a film formation apparatus having a cylindrical can method conveyor device, it is shown in Figs. 7A and 7B that the apparatus for the curved surface roller method is more successful in reducing its size. Fig. 7A is a film formation apparatus having a curved surface roller method conveyor device and using an electrode that also serves as a conveyance supporting portion, and Fig. 7B is a film formation apparatus having a cylindrical can method conveyor device and using a cylindrical can electrode 710 that also serves as a combination conveyance supporting portion. Note, reference numeral 701 denotes a flexible substrate; 702, a ground electrode; 703, an opposing electrode; 704, a roll-out vacuum chamber; 705, a roll-up vacuum chamber; 706, a film formation chamber; 707, a roll-out roll; 708, a roll-up roll; and 709, a guide roll. The conveyor device of Fig. 7A is of a curved surface roller method with a radius of curvature R of 1000mm, and the conveyor device of Fig. 7B is a cylindrical can method with a radius R of 500 mm. The total electrode surface area for each apparatus is about the same size. With the cylindrical can method, the radius can be kept at half of the radius of curvature in the curved surface roller method, but the

entire cylindrical can must be set within the apparatus, and therefore the apparatus is [inevitable] inevitably large. In practice, not only is the size difference in the side face diagram important, but also the difference in volume of a vacuum chamber in a vacuum apparatus is very important. As the vacuum chamber is increased in size, a vacuum chamber wall used has to be thicker and more solid. Therefore the apparatus becomes very heavy, and things such as building floor strength become problems. [the] The vacuum apparatus using a cylindrical can radius R of 500 mm may weigh[t] as heavy as 2 tons. Further, accompanying the increase in size of the vacuum chamber, components such as a vacuum pump used in an evacuation system also become large and high cost. There are many advantages in reducing the size of a film formation apparatus in which the electrode surface area obtained is about the same size, particularly the vacuum apparatus.

A3 cont

Please replace the paragraph beginning at page 11, line 15, with the following rewritten paragraph:

A4

A film formation apparatus having a conveyor device like that shown in Figs. 6A and 6B is prepared. This film formation apparatus is provided with a conveyor device for a flexible substrate, a vacuum chamber, a film formation gas introduction system, an evacuation system, and a high frequency power supply

introduction system which can generate an energy such as an electromagnetic wave, and film formation is performed by plasma CVD. First, a conveyance supporting portion 610 of the curved surface roller method conveyor device is attached to a heater 609, forming the curved surface roller method conveyor device. The conveyance supporting portion of the curved surface roller method conveyor device is used as a ground electrode. The high frequency power supply introduction system is compcsed of the curved surface roller method ground electrode and a nigh frequency power supply side electrode [608] 612. Next, a flexible substrate 601 is set so as to be rolled out from a roll-out roll 607, to pass through a guide roll 606 and the curved surface roller method ground electrode 610, and to be rolled up by a roll-up roll 608. At this point, a constant rotational torque is applied to the roll-out roll 607 in the opposite direction with respect to the roll-up roll 608, and therefore a tensile force is applied to the flexible substrate 601, which comes into close contact with the curved surface of the curved surface roller method ground electrode. Note, reference numeral 603 and 605 indicate a roll-out vacuum chamber and a roll-up vacuum chamber, respectively.

A4 Cont

Please replace the paragraph beginning at page 13, line 8, with the following rewritten paragraph:

Wrinkles in the flexible substrate, and film formation unevennesses caused by the wrinkles, were evaluated. First, a PEN (polyethylene naphthalate) film was used in a flexible substrate, and the substrate was set into the conveying system of the film formation apparatus having the conveyor device shown in Figs. 6A and 6B. Then a tensile force was applied to the flexible substrate. The flexible substrate 601 was observed from a lower portion of the curved surface roller method ground electrode, and no wrinkles were seen in the substrate. Next, silane gas and hydrogen gas were introduced into a film formation chamber 604, and an electric discharge was generated between the high frequency power supply side electrode [608] 612 and the curved surface roller method ground electrode 610, performing film formation of non-single crystal silicon on the flexible substrate. Non-single crystal silicon denotes amorphous silicon, microcrystalline silicon, and thin film polycrystalline silicon. The film thickness of this film was measured using a spectrophotometer and scanning in the width direction of the substrate. Results are shown in Figs. 10A and 10B. Fig. 10A shows a film thickness distribution in the substrate width direction of a film formed by using a parallel plate method film formation apparatus, and Fig. 10B shows a film thickness distribution of a film formed by using the curved surface roller